

which are principally required in the direction of the axis of the shell.....The animal differs from *Solen* in having its siphons free, instead of occupying a common tube; and in having an expanded instead of a conical termination to the foot."

I may also add the following from the characters of the shell: "Epidermis easily detached when dry, folding over the edges and extremities of the shell, and connecting the hinge-margins."

In *Novaculina* there is a strong prominent external ligament, and its internal prolongation is received into a cavity communicating by a lateral posterior opening with the interior of the shell; the salient re-entering teeth—three in the left valve, and two longer in the right—lie under the beaks anteriorly to and quite independent of the ligamental cavity; whereas in *Tanysiphon* two of the teeth in each valve form, as it were, a portion of the wall which separates the ligamental cavity from the interior of the shell, and the anterior tooth in the right valve alone inclines to an independent direction.

For comparison with Dr. Cantor's drawing of the animal of *Tanysiphon*, I add a sketch which I made from a living example of *Novaculina* in Calcutta. It will be observed that the animal failed to protrude the foot, so as to exhibit its form to the extent reached in the Jumna specimens, and that the siphons were also less extended.

Cheltenham, 29th April, 1858.

#### EXPLANATION OF PLATE XII. B.

Fig. 1. *Tanysiphon rivalis*, natural size (nearly).

Fig. 2. Siphonal tube and siphon, magnified.

Fig. 3. Left valve of *Tanysiphon rivalis*.

Fig. 4. *Novaculina Gangetica*, with animal.

Note.—Dr. Cantor's figure having reference chiefly to the animal of *Tanysiphon*, the part which represents the shell fails to exhibit the general form correctly, especially in the umbonal region. The beaks are too prominent, and are deficient in the breadth which characterizes the genus in this as in the corresponding part of *Novaculina*. Fig. 3 shows the true shape.

#### XXXIX.—*Observations on Dracunculus in the Island of Bombay.* By H. J. CARTER, Esq., H.C.S. Bombay\*.

SINCE my "Note on *Dracunculus* in the Island of Bombay" was communicated to the Society in October 1853, and published in the new series of their 'Transactions' (No. 2. p. 45), I have continued to give my attention to the subject when opportunity offered, and have thus been able to correct, to add to, and to

\* Communicated by the author; having been read before the Medical and Physical Society of Bombay, Feb. 6, 1858.

clear up many interesting points connected with this Entozoon. They are as follows :—

1. What I have described and figured as the œsophagus (*loc. cit.*) is but the sheath\* of this organ, inasmuch as the latter may be seen within the former, about 1-600th of an inch in diameter. This corrects the apparent anomaly of the œsophagus being larger, instead of smaller, than the intestine, and makes it agree with the so-called "Tank-worm," whose anatomy, both individually and sexually, with that of other free microscopic *Filaria* in the island of Bombay, I have lately been able to determine most satisfactorily.

2. What appears to be the intestine, in *Dracunculus*, is the hepatic sheath degenerated, within which again is the intestine, about 1-70th of an inch in diameter. This also corresponds with the same organ in the microscopic *Filaria*.

3. There is not the slightest difference of form in any part of the ovisac of *Dracunculus* indicating that it was once double, and united together in the centre to form the vagina, as in the free *Filaria*; nor is there any projection, or difference in the size of its calibre, either in the large portion or in its filiform extremities (which are exactly alike), indicative of its having any connexion with a vaginal aperture.

4. The ovisac *bursts* through the body just behind the head of the *Dracunculus*, on the extrusion of the latter from the human body, and does not pass through an aperture ordained for the evacuation of its contents, in this or in any other part of the worm.

5. The third or "small papilla" which I described and figured about the mouth (*loc. cit.*), and through which I wrongly conjectured that the ovisac might have its exit, has a similar one opposite to it; so that there are two prominent and two rudimentary papillæ, if the latter, which are very small, and cannot be seen to project above the surface, be papillæ at all.

6. The œsophagus, intestine, and position of the anal aperture of the young *Dracunculus* correspond exactly with the same organs and the position of the anus in the free microscopic *Filaria*; but no comparison can be drawn between the generative organs in the two, because they are not developed in the former.

7. Very many species of microscopic *Filaria* abound in myriads in the salt water of the marshes and main drain, in the freshwater tanks, and in the gelatinous Algæ (*Glæocapsa*) which grow on the sides of old walls and gutters, during the rainy monsoon, in the island of Bombay. Out of several hundred specimens of these, I have met with seventeen distinct

forms: viz. seven in the salt water of the marshes and main drain, of which six are males and females of three species respectively; two in the freshwater tanks, male and female; and eight in the gelatinous Algæ on old walls, among which are six, males and females of three species respectively.

8. Of these it may be stated that the organology in all is the same, and, so far as the alimentary canal goes, exactly like that of the young *Dracunculus*. The generative organs and position of the vulva are, in round terms, the same in all,—that is to say, the vulva is situated towards the middle of the body (from which departs in opposite directions the double tubular ovisac); and the penis consists of two horny spicules approximated at an acute angle just inside the anus, from whence it is exsertile. In all, however, the variety in form of the head or tail, or both, serves not only to distinguish the species, but frequently also the sex of the species. In most (probably all) the œsophagus is furnished with a rigid, sharp-pointed extremity, which is exsertile. Lastly, in all, the young are undistinguishable from each other, and closely allied in form to the young *Dracunculus*; the alteration in the head and tail not taking place before the development of the generative organs.

*Observations.*—These facts show that the alimentary canal is of the same construction in the young and old *Dracunculus* as in the free microscopic *Filaria* above mentioned;—that the ovisac of the adult *Dracunculus* is as symmetrical in its two halves as the double ovisac (so-called “uterus”) of the microscopic species, but, from want of a vaginal outlet, is a uniform continuous tube, the diminished extremities of which resemble the diminished extremities of the double ovisac, which are, in fact, the ovaries;—that the bursting forth of the ovisac, therefore, in *Dracunculus* is an inevitable consequence, and has its parallel, according to Van Beneden, in the bursting-forth of the “matrix” or so-called “uterus” under corresponding circumstances (that is, when it becomes distended with ova) in the Cestoid Entozoa, *Tenia solium*;—that the œsophagus in *Dracunculus* being of the same construction as that of the microscopic *Filaria*, is therefore, probably, provided with an exsertile point, which enables it to bore its way through the tissues, after the manner of *Cysticercus*, which is also similarly provided for this purpose; and that this might enable the young of the microscopic species to pass into the human body through the skin direct, or indirectly through the ducts of the sudorific glands, the latter being much larger in calibre (viz. 1-1200th of an inch) than the young *Filariadæ*, which are frequently not wider than a human blood-globule;—that, from what we now know of Parthenogenesis, or

Virgin-generation, the young female microscopic worm might pass into the body already impregnated even before the generative organs can be detected;—that some of the microscopic *Filariæ* above alluded to have two and four minute papillary eminences projecting from their heads, respectively, two of which are larger than the other two, which approximates them still closer to *Dracunculus*;—and lastly, that the microscopic *Filariæ* not only seek a habitat (viz. the gelatinous Algæ and decomposing cells of vegetable matter) where they can obtain nitrogenous food and elements of nutrition like those afforded by the human body, but that it has occurred to me frequently to find a *Nais* (whose habitat also is the *Glæocapsa* during the rainy weather) with its peritoneal cavity containing one or more microscopic *Filariæ*, equal in size to those which are dwelling in the same Alga.

It is true that we have not the means of feeding either man or animals with the young microscopic *Filariæ*, to determine if this would be followed by the production of *Dracunculus*, as the abundance of *Cysticerci* in “measly pork” has enabled Küchenmeister, Van Beneden, Siebold, and others, to prove that the latter, when taken internally, are productive of *Tænia*, or tape-worm; nor would this be likely to succeed if we did possess such means, since it is more than probable that the embryo which produces *Dracunculus*, whatever it may be, enters through the surface of the body. Neither should we be justified in plastering mud over the human body, to satisfy our curiosity in this respect, while the experiment seems to be already performed to our hands, as related in my “Note” under reference, where it is shown that out of a school of fifty boys bathing and dabbling more or less throughout the day in a small pond in their enclosure, whose muddy sediment swarmed with the so-called “Tank-worm,” not less than twenty-one in one year had had *Dracunculus* in more or less plurality; while such was not only not the case in any of the other schools of the island, but in the school of which I have had medical charge for more than ten years, with an average number of 346 children present, only two or three cases have occurred during that time; and microscopic *Filariæ* do not exist, so far as I have been able to ascertain, in the sedimentary deposit of the tank in their enclosure, from which the children of this school are solely supplied with bathing-water.

I have only now to add, in support of the inference conveyed by the above remarks respecting the origin of *Dracunculus*, that Prof. Siebold took the larvæ or caterpillars of *Yponomeuta cognatella* and other Lepidopterous insects, and, having placed them in wet mould which abounded with the embryos of *Mermis albicans*,

a worm closely allied to *Gordius*, found, in every instance, that after twenty-four hours the larvæ became more or less infected with these embryos, which had penetrated into their bodies; while the larvæ of *Yponomeuta* being transparent, enabled this sagacious observer to ascertain, by aid of the microscope, that they did not contain any of these embryos before the experiment of bringing the two into contact with each other was performed\*. Lespés also, while studying the *Termites*, found whole nests destroyed by the embryos of a Nematoid worm just like our microscopic *Filaria*, penetrating their bodies and becoming developed in the peritoneal cavity†, as in the instance above mentioned in *Nais*. If, after this, the origin and mode of introduction of *Dracunculus* into the human body be doubted, I can only reply, that I shall be happy to see a better explanation of it. The facts above stated appear to me as conclusive as those of *Cysticercus* producing *Tænia*, or tape-worm; and therefore it remains only to determine which of the microscopic *Filaria* produces *Dracunculus* in Bombay,—a point which the marked forms of these worms respectively might be expected to render not difficult of demonstration. Indeed, it so happens that the so-called “Tank-worm” (*Urolabes*‡ *palustris*, mihi), which I have taken from the “bathing-pool” of the school mentioned, as well as from other pools, tanks, and collections of dirty fresh water in the island generally, comes nearest to *Dracunculus*. The largest specimens are 1-6th of an inch long, bilabiate, with an exsertile, sharp-pointed œsophagus; the hepatic sheath ending some distance from the termination of the intestine; the vulva opens in the female a little in front of the middle of the body, and the anus posteriorly, just before the body terminates suddenly in a whip-like tail. The penis in the male is exsertile from the anus, *very nearly close* to the posterior extremity of the body, which is so obtuse as to be almost truncated. The tail of the young is semi-geniculated at the base, and there is a gland close to the anus, as in the young *Dracunculus*; that of the adult female varies in length, and becomes curved upon itself when short.

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XL.—*Synopsis of the Families, Genera, and Species of the British Actiniæ.* By P. H. GOSSE, F.R.S.

IN hac Synopsi includuntur tot species Zoophytorum Astræaceorum Britannicorum quot mihi adhuc cognitæ sunt. Desunt

\* Ann. des Sc. Nat. sér. 4. Zool. t. iv. p. 56, 1855.

† Annals, vol. xix. p. 388, 1857.

‡ “A holder-on by the tail,” which is a character common to all these microscopic *Filaria*.